

# New points in IS 335-2018

I	Classification of transformer oil	1	Type I: Transformer oil w.r.t IEC60296						
		2	Type II: High viscosity transformer oil						
II	New Concept	3	Type III: Low viscosity switchgear oil						
			Lowest cold start energizing temperature (pour point of oil : temperature)						
III	New properties included	1	Sulfur content						
		2	Gassing Tendency						
		3	ECT						
		4	PCA						
		5	PCB						
		6	Furan						
IV	Methods revised	1	Acidity						
		2	Corrosive Sulfur						
		3	Oxidation Stability						
V	Standard merged	1	IS 335						
		2	IS 12463						
VI	Acceptable Test Values changed		KV, density, PP, water content, BDV, DDF, acidity, DBDS, me compounds, OS parameters, flash point, PCA and PCB						
VII	Removed typical parameters which was not part of specifications	1	Open beaker ageing						
		2	SK value						
		3	Resistivity						

Changes by clause.

Sr No	Parameter	IS 2018			IS 335:1993 RA 2010			Remark
		Type I	Type II	Type III	Method	Method	Specifications	
1	Viscosity, cSt	0°C	1800	-	IS 1448 P25	Not mentioned	27	
		27°C	Removed	3.5	IS 1448 P25	IS 1448 P25	Under consideration	
		40°C	12	-	IS 16084	Not mentioned	-6°C	
		-30°C	1800	-	IS 1448 P10/Sec2	IS 13567	50	
2	Pour Point, °C max	-40°C	-10°C	-60°C	IS 1448 P10/Sec2	IS 1448 P10/Sec2	-6°C	
3	Water Content, ppm Max	For Bulk: 30; For drum/IBC: 40			IEC 60814	IS 13567	As such: 30; After lab treatment: 60	
4	BDV, kV Min	As such: 30; After laboratory treatment: 70			IS 6792	IS 6792	As such: 30; After lab treatment: 60	
5	Density, g/ml max	20°C	0.895	Removed	IS 1448 P16	IS 1448 P16	0.89	
6	DDF, 90°C Max	29.5°C	0.005	Removed	IS 16086	IS 1448 P16	0.002	
7	Particle content	No general requirement (agreed bet customer and supplier)			IS 13236	Not mentioned	0.03	
8	Acidity, mg KOH/g max	Total	0.01	Removed	IEC 62021-1	IS 1448 P2	NIL	
9	IFT, mN/m	Inorganic acidity	No general requirement (recommenced 40.0)			Do	0.04N/m at 27°C	
10	Total Sulphur content	No general requirement			ASTM D 971	IS 6104	Not Mentioned	
11	Corrosive Sulphur	Not corrosive			ISO 14596 or ASTM D4294	Annex B	Non corrosive	
12	Potentially corrosive sulphur	Not corrosive			DIN 51353	IS 13161	Not Mentioned	
13	Inhibitors content	Uninhibited: <0.01%; Trace inhibited: <0.08%; Inhibited: 0.08-0.4%			IS 16310	IS 13161	Max 0.5 SK value	quantitative method is under consideration in 1993 RA 2010
14	Metal passivator	Not detectable (<5mg/kg) or agreed upon with the purchaser			IS 13631/ IEC 60666	Not Mentioned		
15	Other additive	Supplied shall declare			IS 15668	Not Mentioned		
16	2-Furfural and related compounds	Not detectable (<5mg/kg) or agreed upon with the purchaser			IS 12422 Method C	Not mentioned		
17	Oxidation stability	U: 164 hrs; T: 332 hrs; I: 500 hrs			IS 12422	IS 335 Annex C	0.4 mg KOH/g	
		1.2 mg KOH/g, Max			IS 12422	Not Mentioned	0.1% w/w	
18	Gassing tendency	DDF at 90°C			IS 12422	Not Mentioned		
19	ECT	No general requirement (agreed between purchaser and supplier)			IEC 60628 Method A	Not Mentioned		
20	Flash Point	No general requirement (agreed between purchaser and supplier)			IS 335:2018 cl.614	Not Mentioned		
21	PCA content	Min	135°C	100°C	IS 1448 P21	IS 1448 P21	140°C	
22	PCB content	Not detectable (<2mg/kg)			IP 346	Not Mentioned		

Other Removed tests

- 1 Open beaker aging
- 2 SK value

• Other Additional tests are not included in specifications in IS 335:2018

- 1 Sampling: according to IS 6855
- 2 Particle count according to IS 13236
- 3 Stray gassing according to CIGRE brochure 296 or ASTM D7150

# New points in IS 335.2018

1	Classification of transformer oil	Type I: Transformer oil w.r.t IEC60296 Type II: High viscosity transformer oil Type III: Low viscosity switchgear oil
2	New Concept	Lowest cold start energizing temperature (pour point of oil should lower 10°C than min charging temperature)
3	New properties included	Sulfur content, gassing tendency, PCA, PCB and furan
4	Methods revised	Acidity, corrosive sulfur, oxidation stability
5	Standard withdrawn	IS 12463
6	Values changed	
7	Removed typical parameters which was not part of specifications	Coeff. of expansion, permittivity, specific heat, thermal conductivity,

Transformer Oil Specification					
STANDARDS		Inhibited Oil Special		IEC	
S. No.	Characteristics	IS : 335 , August 2018 Revision Type I	IS : 335 , August 2018 Revision Type II	IEC 60296 , 2012	Remark
A.	FUNCTION				
1	KV at 27 °C, mm2/s,Max	27	NA	NA	In 2018 standard, oils are classified in to 3 categories as transformer oil Type I, Type II and low temp switchgear oil
2	KV at 40 °C, mm2/s,Max	NA	12	12	
3	KV at 0 °C, mm2/s,Max				
4	KV at -30 °C, mm2/s,Max	NA	1800	1800	In 2018 standard, viscosity at 40°C is asked, while in 2010 it was asked at 27°C
5	Pour Point, °C,Max	-6	-40	-10	In 2018 standard, PP value is raised
6	Water Content, mg/kg, Max			-40	In 2018 standard, requirement is stringent. The value is reduced.
	Bulk delivery	50	30	30	
	Drum delivery		40	40	
7	BDV				No difference except after treatment (70 KV in standard 2018)
	(a) As delivered (kv),Min	30	30	30	
	(b) After treatment (kv) , Min	60	70	70	
8	Density @ 29.5°C , g /ml Max	NA	NA	NA	In 2018 standard, density is mentioned at 20°C
	Density @ 20°C , g/ ml Max	0.89	0.895	0.895	
9	Resistivity At 90 °C, Min	$3.5 \times 10^{12}$	NA	NA	Removed from 2018 standard
10	Resistivity At 27 °C, Min	$1500 \times 10^{12}$	NA	NA	
	Tan Delta at 90°C, Max	0.002	0.005	0.005	In 2018, DDF value is increased to 0.005
B.	REFINING / STABILITY				
11	Appearance	Clear & transparent and free from suspended matter or sediments	Clear free from sediment and suspended matter	Clear free from sediment and suspended matter	
12	Colour, Max	NA	NA	NA	
13	Total Acidity, Max	0.03	0.01 mgKOH/G, Max	0.01 mgKOH/G, Max	In 2018 standard, the acidity is reduced. Made it stringent than 2010 standard.
14	Interfacial tension,Min	40	No general requirement	No general requirement	*Where it is used as general requirement, a limit of minimum 40 mN/m is recommended.
15	Corrosive Sulphur	Not Corrosive	Not Corrosive	Not Corrosive	
	Potentially Corrosive Sulphur	NA	Not Corrosive	Not Corrosive	Spec is added in 2018 standard. Test method IS 16310
16	DBDS, mg/kg, Max	NA	Not Decable (< 5 mg/kg)	Not Decable (< 5 mg/kg)	Spec is added in 2018 standard. Test method IS 16497 (part 1)
17	Metal Passivator,mg/kg,Max	NA	Not Decable (< 5 mg/kg)	Not Decable (< 5 mg/kg)	Spec is added in 2018 standard. Test method IS 13631
18	Anti-oxidant additives%, Max	0.3	0.08 - 0.4	0.08 - 0.4	In 2018 standard, total inhibitor content in between 0.08 to 0.4 % considered as inhibited oil
19	2-Furfural and related compounds content,	NA	Not Decable (< 0.05 mg/kg)	Not Decable (< 0.05 mg/kg)	Spec is added in 2018 standard. Test method IS 15688
20	Total Sulphur Content, %	NA	0.05	0.05	Spec is added in 2018 standard. In case of despute use ISO 14596 or ASTM D4294
C.	PERFORMANCE				
21	OS (After 164 h at 100°C)				This OS test method is not valid in 2018 standard and it is modified as given in sr. no. 22
	(a) Total Acidity, Max	0.4	NA	NA	
	(b) Total Sludge, % Max	0.1	NA	NA	
	(c) DDF @ 90 °C, Max	NA	NA	NA	
	After Ageing				
	Resistivity At 27 °C, Min	NA	NA	NA	
	Resistivity At 90 °C, Min	NA	NA	NA	
	DDF @ 90 °C, Max	NA	NA	NA	
	Total Acidity, Max	NA	NA	NA	
	Total Sludge, % Max	NA	NA	NA	
22	OS (After 500 h at 120°C)				
	(a) Acidity , max mgKOH/G	NA	0.3	0.3	It is a special requirement for special purpose.
	(b) Total Sludge, % Max	NA	0.05	0.05	In 2018 standard, the reaction parameters are changed to 120°C from 100°C. The DDF & total S content is added. For this test only total S testing is added. The resultant acceptable limits are changed as mentioned in the table.
	(c) DDF @ 90 °C, Max	NA	0.05	0.05	
	(D) Total sulphur content, %, Max before OS test	NA	0.05	0.05	
23	Gassing Tendency	NA	No general requirement	No general requirement	Spec is added in 2018 standard. Test method IEC 60628, Method A. If considered, the value be agreed upon between supplier and purchaser.
24	ECT	NA	No general requirement	No general requirement	Spec is added in 2018 standard. Test method CIGRE Technical Brochure 170
D.	HEALTH, SAFETY AND ENVIRONMENT (HSE)				
25	Flash Point, °C (PMCC),Min	140	135	135	In 2018 standard, the value is reduced by 5°C
26	Polycyclic Aromatics (PCA), % mass,	NA	NA	3%, Max	Spec is added in 2018 standard. Test method IP 346
27	PCB content	NA	NA	Not Detectable (< 2 mg/kg)	Spec is added in standard 2018. Test method IS 16082
28	S.K Value, %	Under Consideration	NA	NA	Removed from 2018 standard



# Transformer Oil Specification

STANDARDS		Inhibited Oil		IEC		Remark
S. No.	Characteristics	IS 12463	IS : 335, August 2018 Revision Type I	IS : 335, August 2018 Revision Type II	IEC 60296, 2012	
A.	FUNCTION					In 2018 standard, oils are classified in to 3 categories as transformer oil Type I, Type II and low temp switchgear oil
1	KV at 27 °C, mm2/s, Max	27	NA	NA	NA	In 2018 standard, viscosity at 40°C is asked, while in 2010 it was asked at 27°C
2	KV at 40 °C, mm2/s, Max	NA	12	15	12	
3	K V at 0 ° C, mm2/s, Max			1800		
4	K V at -30 ° C, mm2/s, Max	NA	1800		1800	
5	Pour Point, ° C, Max	-6	-40	-10	-40	In 2018 standard, PP value is raised
6	Water Content, mg/kg, Max					In 2018 standard, requirement is stringent. The value is reduced.
	Bulk delivery					
	Drum delivery	50	30	30	30	
7	BDV		40	40	40	
	(a) As delivered (kv), Min	30	30	30	30	No difference except after treatment (70 kV in standard 2018)
	(b) After treatment (kv), Min					
8	Density @ 29.5°C, g / ml Max	60	70	70	70	
	Density @ 20°C, . g/ ml Max	NA	0.895	NA	NA	In 2018 standard, density is mentioned at 20°C
9	Resistivity At 90 °C, Min		0.89	0.895	0.895	
	Resistivity At 27 °C, Min		35 x 10 <sup>12</sup>	NA	NA	Removed from 2018 standard
10	Tan Delta at 90°C, Max		1500 x 10 <sup>-12</sup>	NA	NA	
B.	REFINING / STABILITY		0.005	0.005	0.005	In 2018, DDF value is increased to 0.005
11	Appearance	Clear & transparent and free from suspended matter or sediments	Clear free from sediment and suspended matter	Clear free from sediment and suspended matter	Clear free from sediment and suspended matter	
12	Colour, Max	NA	NA	NA	NA	
13	Total Acidity, Max	0.03	0.01 mgKOH/G, Max	0.01 mgKOH/G, Max	0.01 mgKOH/G, Max	In 2018 standard, the acidity is reduced. Made it stringent than 2010 standard.
14	Interfacial tension, Min	40	No general requirement	No general requirement	No general requirement	*Where it is used as general requirement, a limit of minimum 40 mN/m is recommended.
15	Corrosive Sulphur	Not Corrosive	Not Corrosive	Not Corrosive	Not Corrosive	
16	Potentially Corrosive Sulphur	NA	Not Corrosive	Not Corrosive	Not Corrosive	Spec is added in 2018 standard. Test method IS 16310
17	DBDS, mg/lsg, Max	NA	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Spec is added in 2018 standard. Test method IS 16497 (Part 1)
18	Metal Passivator, mg/kg, Max	NA	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Spec is added in 2018 standard. Test method IS 13631
19	Anti-oxidant additives, %, Max	0.3	0.08 - 0.4	0.08 - 0.4	0.08 - 0.4	In 2013 standard, total inhibitor content in between 0.08 to 0.4 % considered as inhibited oil
20	2-Purpurin and related compounds content, %	NA	Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)	Spec is added in 2018 standard. Test method IS 15688
	Total Sulphur Content, %	NA				Spec is added in 2018 standard. In case of despute use ISO 14596 or ASTM D4294
C.	PERFORMANCE		0.05	0.05	0.05	
21	OS (After 164 h at 100°C)					
	(a) Total Acidity, Max	0.4	NA	NA	NA	
	(b) Total Sludge, % Max	0.1	NA	NA	NA	This OS test method is not valid in 2018 standard and it is modified as given in sr. no. 22
	(c) DDF @ 90 °C, Max	NA	NA	NA	NA	
	After Ageing					
	Resistivity At 27 °C, Min	NA	NA	NA	NA	
	Resistivity At 90 °C, Min	NA	NA	NA	NA	
	DDF @ 90 °C, Max	NA	NA	NA	NA	
	Total Acidity, Max	NA	NA	NA	NA	
	Total Sludge, % Max	NA	NA	NA	NA	
22	OS (After 500 h at 120°C)		(After 500 h at 120°C)	(After 500 h at 120°C)		
	(a) Acidity, max mgKOH/G	NA	1.2	1.2	1.2	It is a special requirement for special purpose.
	(b) Total Sludge, % Max	NA	0.8	0.8	0.8	In 2018 standard, the reaction parameters are changed to 120°C from 100°C. The DDF & total S content is added. For this test only total S testing is added. The resultant acceptable limits are changed as mentioned in the table.
	(c) DDF @ 90 °C, Max	NA	0.5	0.5	0.5	
	(D) Total sulphur content, %, Max before OS test	NA	0.05	0.05	0.05	
23	Gassing Tendency					
		NA	No general requirement	No general requirement	No general requirement	Spec is added in 2018 standard. Test method IEC 60628, Method A. If considered, the value be agreed upon between supplier and purchaser.
24	ECT	NA	No general requirement	No general requirement	No general requirement	Spec is added in 2018 standard. Test method CIGRE Technical Brochure 170
D.	HEALTH, SAFETY AND ENVIRONMENT (HSE)					
25	Fish Point, °C (PMCC), Min	140	135	135	135	In 2018 standard, the value is reduced by 5°C
26	Polycyclic Aromatics (PCA), % mass.	NA	NA	3%, Max	3%, Max	Spec is added in 2018 standard. Test method IP 346
27	PCB content	NA	NA	Not Detectable (< 2 mg/kg)	Not Detectable (< 2 mg/kg)	Spec is added in standard 2018. Test method IS 16082
28	S.K Value, %	Under Consideration	NA	NA	NA	Removed from 2018 standard

Transformer Oil Specification					
STANDARDS		Trace Inhibited Oil		IEC	Remark
S. No.	Characteristics	IS : 335, 2010 No Product	IS : 335, August 2018 Revision Type I	IS : 335, August 2018 Revision Type II	IEC 60296 , 2012
<b>A. FUNCTION</b>					
1	KV at 27 °C , mm2/s ,Max		NA		NA
2	KV at 40 °C , mm2/s ,Max		12	15	12
3	KV at 0 °C , mm2/s ,Max			1800	
4	KV at -30 °C , mm2/s ,Max		1800		1800
5	Pour Point , °C,Max		-40	-10	-40
6	Water Content, mg/kg, Max				
	Bulk delivery		30	30	
	Drum delivery		40	40	
7	BDV				
	(a) As delivered (kv),Min		30	30	30
	(b) After treatment (kv) , Min		70	70	70
8	Density @ 29.5°C ,g /ml Max		NA	NA	NA
	Density @ 20°C ,g/ ml Max		0.895	0.895	0.895
9	Resistivity At 90 °C, Min		NA	NA	NA
	Resistivity At 27 °C, Min		NA	NA	NA
10	Tan Delta at 90°C,Max		0.005	0.005	0.005
<b>B. REFINING / STABILITY</b>					
11	Appearance		Clear free from sediment and suspended matter	Clear free from sediment and suspended matter	
12	Colour, Max				NA
13	Total Acidity, Max		0.01 mgKOH/g, Max	0.01 mgKOH/g, Max	0.01 mgKOH/g, Max
14	Interfacial Tension,Min		*No general requirement	*No general requirement	No general requirement
15	Corrosive Sulphur		Not Corrosive	Not Corrosive	Not Corrosive
16	Potentially Corrosive Sulphur		Not Corrosive	Not Corrosive	Not Corrosive
	DBDS, mg/kg, Max		Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)
17	Metal Passivator,mg/kg, Max		Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)
18	Anti-oxidant additives,%, Max		<0.08%	< 0.08%	< 0.08%
19	Furanic compounds		Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)
20	Total Sulphur Content		No general requirement	No general requirement	No general requirement
<b>C. PERFORMANCE</b>					
21	<b>O.S (After 164 h at 100°C)</b>				
	(a) Total Acidity, Max		NA	NA	NA
	(b) Total Sludge, % Max		NA	NA	NA
	( c ) DDF @ 90 °C, Max		NA	NA	NA
	After Ageing				
	Resistivity At 27 °C, Min		NA	NA	NA
	Resistivity At 90 °C, Min		NA	NA	NA
	DDF @ 90 °C, Max		NA	NA	NA
	Total Acidity, Max		NA	NA	NA
	Total Sludge, % Max		NA	NA	NA
22	<b>O.S (After 164 h at 120°C)</b>		(After 164 h at 120°C)	(After 164 h at 120°C)	
	(a) Acidity , max mgKOH/g		1.2	1.2	1.2
	(b) Total Sludge, % Max		0.8	0.8	0.8
	(C) DDF @ 90 °C, Max		0.5	0.5	0.5
23	Gassing Tendency		No general requirement	No general requirement	No general requirement
24	ECT		No general requirement	No general requirement	No general requirement
<b>D. HEALTH, SAFETY AND ENVIRONMENT (HSE)</b>					
25	Flash Point,°C (PMCC),Min		135	135	135
26	Polycyclic Aromatics (PCA), % mass,		3%, Ma.,	3%, Max	3%, Max
27	PCB content		Not Detectable (< 2 mg/kg)	Not Detectable (< 2 mg/kg)	Not Detectable (< 2 mg/kg)
28	S.K. Value, %		NA	NA	NA

In 2018 standard, oils are classified in to 3 categories as transformer oil Type I, Type II and low temp switchgear oil

In 2018 standard, viscosity at 40°C is asked, while in 2010 it was asked at 27°C

In 2018 standard, PP value is raised

In 2018 standard, requirement is stringent. The value is reduced.

No difference except after treatment (70 kv in standard 2018)

In 2018 standard, density is mentioned at 20°C

Removed from 2018 standard

In 2018, DDF value is increased to 0.005

In 2018 standard, the acidity is reduced. Made it stringent than 2010 standard.

\*Where it is used as general requirement, a limit of minimum 40 mN/m is recommended.

Spec is added in 2018 standard. Test method IS 16310

Spec is added in 2018 standard. Test method IS 16497 (Part 1)

Spec is added in 2018 standard. Test method IS 13631

In earlier 2010 standard, quantification of inhibitor was absent while in 2018 standard, total inhibitor content shall

below 0.01 % is considered as uninhibited oil

Spec is added in 2018 standard. Test method IS 15688

Spec is added in 2018 standard. In case of dispute use ISO 14596 or ASTM D4294

This OS test method is not valid in 2018 standard and it is modified as given in sr. no. 22

In 2018 standard, the reaction parameters are changed to 120°C from 100°C. The DDF is added. The resultant acceptable limits are changed as mentioned in the table.

Spec is added in 2018 standard. Test method IEC 60628, Method A. If considered, the value be agreed upon between supplier and purchaser.

Spec is added in 2018 standard. Test method CIGRE Technical Brochure 170

In 2018 standard, the value is reduced by 5°C

Spec is added in 2018 standard. Test method IP 346

Spec is added in standard 2018. Test method IS 16082

Removed from 2018 standard

Transformer Oil Specification					
STANDARDS		Uninhibited Oil		IEC	Remark
S. No.	Characteristics	IS : 335, 2010	IS : 335 , August 2018 Revision Type I	IS : 335 , August 2018 Revision Type II	IEC 60296 , 2012
FUNCTION					
1	KV at 27 °C, mm2/s, Max	27	NA	NA	NA
2	KV at 40 °C, mm2/s, Max	NA	12	15	12
3	KV at 0 °C, mm2/s, Max			1800	
4	KV at 30 °C, mm2/s, Max	NA	1800	-10	1800
5	Pour Point, °C, Max	-6	-40		-40
6	Water Content, mg/kg, Max				
	Bulk delivery	50	30	30	
	Drum delivery		40	40	
7	BDV				
	(a) As delivered (lv), Min	30	30	30	30
	(b) After treatment (kv), Min	60	70	70	70
8	Density @ 29.5°C, g/ml Max	0.89	NA	NA	NA
	Density @ 20°C, g/ml Max	NA	0.895	0.895	0.855
9	Resistivity At 90 °C, Min	$35 \times 10^{12}$	NA	NA	NA
10	Resistivity At 27 °C, Min	$1500 \times 10^{12}$	NA	NA	NA
	Tan Delta at 90°C, Max	0.002	0.005	0.005	0.005
B. REFINING / STABILITY					
11	Appearance		Clear free from sediment and	Clear free from sediment and	
12	Colour, Max	NA			NA
13	Total Acidity, Max	0.03	0.01 mgKOH/g, Max	0.01 mgKOH/g, Max	0.01 mgKOH/g, Max
14	Interfacial tension, Min	40	*No general requirement	*No general requirement	No general requirement
15	Corrosive Sulphur		Not Corrosive	Not Corrosive	Not Corrosive
	Potentially Corrosive Sulphur	NA	Not Corrosive	Not Corrosive	Not Corrosive
16	DBDS, mg/kg, Max	NA	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)
17	Metal Passivator, mg/kg, Max	NA	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)	Not Detectable (< 5 mg/kg)
18	Anti-oxidant additives%, Max	N D	Not Detectable (< 0.01%)	Not Detectable (< 0.01%)	Not Detectable (< 0.01%)
19	Phenolic compounds	NA	Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)	Not Detectable (< 0.05 mg/kg)
20	Total Sulphur Content	NA	No general requirement	No general requirement	No general requirement
C. PERFORMANCE					
21	OS (After 164 h at 100°C)				
	(a) Total Acidity, .Max	0.4	NA	NA	NA
	(b) Total Sludge, % Max	0.1	NA	NA	NA
	(c) DDF @ 90 °C, Max	NA	NA	NA	NA
	After Ageing				
	Resistivity At 27 °C, Min	$2.5 \times 10^{12}$	NA	NA	NA
	Resistivity At 90 °C, Min	$0.2 \times 10^{13}$	NA	NA	NA
	DDF @ 90 °C, Max	0.2	NA	NA	NA
	Total Acidity, .Max	0.05	NA	NA	NA
	Total Sludge, % Max	0.05	NA	NA	NA
22	OS (After 164 h at 120°C)		(After 164 h at 120°C)	(After 164 h at 120°C)	
	(a) Acidity, max mgKOH/g	NA	1.2	1.2	1.2
	(b) Total Sludge, % Max	NA	0.8	0.8	0.8
	(c) DDF @ 90 °C, Max	NA	0.5	0.5	0.5
23	Gassing Tendency	NA	No general requirement	No general requirement	No general requirement
24	ECT	NA	No general requirement	No general requirement	No general requirement
D. HEALTH, SAFETY AND ENVIRONMENT (HSE)					
25	Flash Point, °C (PMCC), Min	140	135	135	135
26	Polycyclic Aromatics (PCA), % mass,	NA	3%, Max	3%, Max	3%, Max
27	PCB content	NA	Not Detectable (< 2 mg/kg)	Not Detectable (< 2 mg/kg)	Not Detectable (< 2 mg/kg)
28	S/K Value, %	Under Consideration	NA	NA	NA

In 2018 standard, oils are classified in to 3 categories as transformer oil Type I, Type II and low temp switchgear oil

In 2018 standard, viscosity at 40°C is asked, while in 2010 it was asked at 27°C

In 2018 standard, \*P value is raised

In 2018 standard, \*requirement is stringent. The value is reduced.

No difference except after treatment (70 kV in standard 2018)

In 2018 standard, density is mentioned at 20°C

Removed from 2018 standard

In 2018, DDF value is increased to 0.005

In 2018 standard, the acidity is reduced. Made it stringent than 2010 standard.

\*Where it is used as general requirement, a limit of minimum 40 mN/cm is recommended.

Spec is added in 2018 standard. Test method IS 16310

Spec is added in 2018 standard. Test method IS 16497 (Part 1)

Spec is added in 2018 standard. Test method IS 13631

In earlier 2010 standard, quantification of inhibitor was absent while in 2018 standard, total inhibitor content shall

below 0.01 % is considered as uninhibited oil

Spec is added in 2018 standard. Test method IS 15688

Spec is added in 2018 standard. In case of despute use ISO 14596 or ASTM D4294

This OS test method is not valid in 2018 standard and it is modified as given in sr. no. 22

In 2018 standard, the reaction parameters are changed to 120°C from 100°C. The DDF is added. The resultant acceptable limits are changed as mentioned in the table.

Spec is added in 2018 standard. Test method IEC 60628, Method A. If considered, the value be agreed upon between supplier and purchaser.

Spec is added in 2018 standard. Test method CIGRE Technical Brochure 170

In 2018 standard, the value is reduced by 5°C

Spec is added in 2018 standard. Test method IP 346

Spec is added in 2018 standard. Test method IS 16082

Removed from 2018 standard